BS EN 1493:2022



BSI Standards Publication

Vehicle lifts

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National foreword

This British Standard is the UK implementation of EN 1493:2022. It supersedes BS EN 1493:2010, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/12/3, Lifting Platforms - Vehicle lifting devices.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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NORME EUROPÉENNE

EUROPÄISCHE NORM

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November 2022

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English Version

Vehicle lifts

Élévateurs de véhicules

Fahrzeug-Hebebühnen

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European foreword

This document (EN 1493:2022) has been prepared by Technical Committee CEN/TC 98 “Lifting platforms”, the secretariat of which, is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1493:2010.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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Introduction

This document is a type C standard as stated in EN ISO 12100:2010.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered, are both indicated in the scope of this document. In addition, machinery should comply as appropriate with EN ISO 12100:2010 for hazards which are not covered by this document.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

The object of this document is to define rules for safeguarding persons against the risk of accidents associated with the operation of vehicle lifts.

While devising this document it was assumed that only authorized persons operate or use the vehicle lifts and that the working area is sufficiently lit.

The requirement concerning loading control is not deemed pertinent to this document in so far as:

— experience and the state of the art suggests that failing to observe this requirement has not historically given rise to unsafe situations;

— such devices which would give protection against overall and local overloading are not currently available in forms which cover all eventualities;

— the weight and weight distribution is freely available for the type of vehicles to be lifted and as such it is the responsibility of the user to prevent an unsafe situation arising;

— vehicle lifts are generally designed to suit the maximum weight of vehicle to which it would reasonably be subjected, hence the normal duty of a lift is substantially lower than the maximum.

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1 Scope

This document is applicable to stationary and mobile vehicle lifts, which are not intended to lift persons but which are designed to raise vehicles totally, for the purpose of examining and working on or under the vehicles whilst in a raised position. The vehicle lift may consist of one or more lifting units.

Power supply to the vehicle lift by internal combustion engines is not considered.

The floor or ground supporting the vehicle lift in use is assumed to be horizontal.

This document does not exclude a person from entering a lifted vehicle on wheel supporting lifts, e.g. for special works or for periodical technical inspection, and vehicle lifts for rail-bound vehicles.

This document does not contain requirements for hazards which may arise on vehicle lifts where the carrying device can be tilted.

NOTE Noise does not play a role in vehicle lifts in the majority of cases and is therefore not considered in this document.

This document does not apply to:

— vehicle lifts movable when loaded;

— equipment for power driven parking of motor vehicles (see EN 14010:2003+A1:2009).

This document is applicable to vehicle lifts which are manufactured six months after the date of its publication as a European Standard.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13557:2003+A2:2008, *Cranes - Controls and control stations*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2016, modified)*

EN 60204-32:2008, *Safety of machinery - Electrical equipment of machines - Part 32: Requirements for hoisting machines (IEC 60204-32:2008)*

EN 60529:1991[1], *Degrees of protection provided by enclosures (IP Code)*

EN 60947-5-1:2017[2], *Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices*

EN ISO 4413:2010, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)*

[1] As impacted by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.
[2] As impacted by EN 60947-5-1:2017/AC:2020-05.

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EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13849-1:2015, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)*

EN ISO 13850:2015, *Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)*

ISO 4301-1:2016, *Cranes - Classification - Part 1: General*

ISO 16625:2013, *Cranes and hoists - Selection of wire ropes, drums and sheaves*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 General

3.1.1
vehicle lift
lifting device with guided load carrying device for lifting land based means of transportation such as cars, motorcycles, lorries, buses, trams, rail vehicles, industrial trucks and similar, and which is designed to allow working on or under the raised vehicle

Note 1 to entry: The guidance of the load carrying device is given by the supporting structure.

Note 2 to entry: The following types of vehicle lift are examples of those covered by this definition: single and multi-column lifts, single and multi-cylinder lifts, mobile column lifts, scissor and parallelogram lifts, short stroke lifts, which support vehicle wheels, chassis or other designated lifting points (see Annex C).

3.1.2
normative vehicle
theoretical vehicle representative of the normal vehicles on which a lift is intended to operate, used as reference vehicle for structural calculations of the lift itself (see 4.7.4.2, 4.7.4.3)

3.1.3
normal vehicle
land based mean of transport such as cars, motorcycles, lorries, buses, trams, trucks and similar commonly on the road

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3.1.4
special vehicle
vehicle that does not fall within the *normal vehicle* types and for which the Normative Vehicle is no longer representative (i.e.: fork-lifts, dumpers, snowcats, rail bound vehicles, mobile cranes, ...)

3.1.5
wheel track
WT
distance between the centre lines of the wheels on one axle or between centre lines of wheel pairs on twin wheel axles

3.1.6
wheelbase
distance between the centres of wheels of front and rear axle or from the centre of the wheels on the front axle to a point mid-way between axle pairs on twin axle vehicles

3.1.7
rated load
maximum load that a lift has been designed to carry referring to the normative vehicle or to special vehicles mentioned in 4.7.4.4

3.1.8
lifting capacity
maximum load that a single independent lifting unit has been designed to carry when part of a multiple lifting unit lift

3.1.9
lifting height
distance between the floor where the user is standing and the vehicle's pickup points

3.1.10
hazardous area
area under the load carrying device and under the lifted vehicle

Note 1 to entry: The hazardous area is part of the hazard zone according to EN ISO 12100:2010, 3.11.

3.1.11
operator
competent and authorized person to operate the lift and work on the vehicle

3.1.12
bystander
person other than the operator near the vehicle lift

3.1.13
initial position
lower limit position of the carrying device

3.1.14
unauthorised use
use by a person who has not received permission to operate the lift and instruction on its safe operation

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3.1.15
periodical test investigation
PTI
periodic roadworthiness tests for motor vehicles and their trailers in accordance with current legislation

3.2 Lift parts

3.2.1
drive system
components and systems for lifting and lowering movements, including power source, controls and lifting elements

Note 1 to entry: Examples are:

— in electrohydraulic lifts: Electrohydraulic unit, cylinders, ropes, electric controls;

— in electromechanical lifts: Electric motor + transmission (pulley, gear box, ...), lifting screws, electric controls.

3.2.2
lifting unit
lifting device in general made up of a load carrying device, a supporting structure and its drive system

Note 1 to entry: A lifting unit may share parts of its drive system with other lifting units.

Note 2 to entry: Examples of lifting units are one column of a two column lift (see Figure C.2), one unit of a double-scissor lift (see Figure C.3).

3.2.3
independent lifting unit
lifting unit not sharing any part of or all of the drive system with other lifting units

Note 1 to entry: Example of an independent lifting unit is a single column of a mobile column lift.

3.2.4
supporting structure
part(s) of the vehicle lift which offer guidance to the load carrying device, but which do not move when the load is raised/lowered

EXAMPLE The posts on a two/four post lift.

3.2.5
load carrying device
part(s) of the vehicle lift which support the load either by direct contact with the vehicle or through contact with pick-up plates and/or pads

Note 1 to entry: The load carrying device is the part of the structure of the lift which is moving when the load is raised/lowered.

EXAMPLE Platforms, carrying arms or other mechanical devices designed to raise and support a vehicle by designated lifting points.

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3.2.6
lifting element
medium through which the force is transmitted from the power source to the load carrying device

Note 1 to entry: Lifting elements include hydraulic and pneumatic cylinders, lead screw and nut systems as well as any flexible connections such as steel wire ropes and chains but excluding the ropes/chains having the sole scope of synchronising different lifting units.

3.2.7
mechanical lifting element
lifting element constructed from engineering materials and which may be reasonably subjected to wear

Note 1 to entry: Mechanical lifting elements are e.g. ropes, chains, carrying nuts and gears. Hydraulic and pneumatic cylinders do not fall under this definition.

3.2.8
carrying arm
load carrying device attached at one end, directly or indirectly to the lifting element and supporting the load at its other end

Note 1 to entry: Carrying arms are as an example used on two column lifts.

3.2.9
platform
horizontal surface or structure, part of the load carrying device, designed to drive on it with the vehicle when entering/leaving the vehicle lift

Note 1 to entry: E.g. tracks in scissor lifts.

3.2.10
pick-up plate
part of the load carrying device, e.g. on two column lifts with carrying arms, which has direct contact to the vehicle and which has an assigned position on the load carrying device

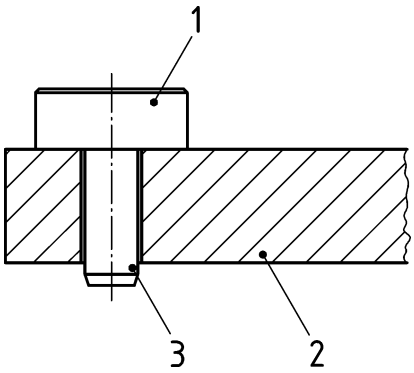
Note 1 to entry: See Figure 1.

3.2.11
pick-up pad
vehicle supporting pad which has direct contact with the vehicle but which does not have an assigned position, e.g. pads used on wheel free systems with platforms

Note 1 to entry: See Figure 2.

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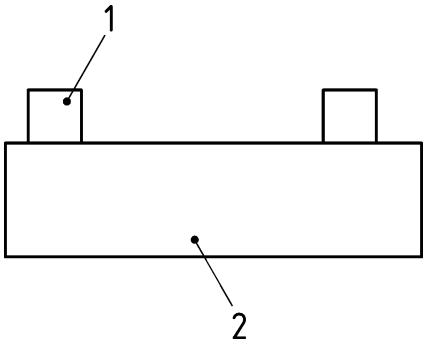
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Key

1 pick-up plate
2 load carrying device
3 pin

Figure 1 — Pick-up plate



Key

1 pick-up pad
2 platform

Figure 2 — Pick-up pad

3.2.12
roll off safety device
device that prevents the vehicle from rolling off the platforms of wheel support vehicle lifts in the event of involuntary movement of the vehicle

Note 1 to entry: The roll off safety device is not the single wheel stop but is the whole system that prevents the vehicle from falling off (i.e. both wheel stops when you have two, the single wheel stop when you have one …).

3.2.13
wheel stop
part of roll off safety device at the end of a platform on vehicle lifts which opposes the movement of the wheel of the vehicle

3.2.14
end stop
mechanical stop that limits the movement of elements within maximum admissible values, ensuring the maintenance of the intended function of the system

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3.2.15
control device
device through which the operator commands at least one of the working functions of the lift

3.2.16
fixed control
control device fixed to the structure of the lift or in any case set in a predefined fixed position when the lift is installed (e.g. fixed control console, controls installed on the walls of the workshop where the lift is installed)

3.2.17
mobile control
control device not fixed to the lift structure or somewhere else

3.2.18
remote control
handheld control device connected to the lift's electrical system via cable or wireless that allows the lift to be operated remotely from the main control

3.2.19
consensus control device
additional control having the sole function of confirming the command implemented by the main control

3.2.20
wheel free system
lifting unit which is used in conjunction with a pit or vehicle lift with platform lifting the whole vehicle and allows the wheels to be removed

3.3 Lift type

3.3.1
multiple lifting unit lift
combination of independent units lifts or two or more vehicle lifts matched to each other

Note 1 to entry: A mobile column lift or two or more lifts installed each one after in tandem with the other and synchronized with each other are examples of multiple lifting unit lift.

3.3.2
short stroke lift
floor mounted vehicle lift with a maximum vertical travel of not more than 500 mm, which is not designed for working under the raised load

Note 1 to entry: These lifts are different to wheel free systems according to 3.2.20.

3.3.3
long lifting system
lifting system consisting of several lifting units distributed over a distance of more than 15 m

3.3.4
scissor lift
vehicle lift where the vehicle is supported on its wheels or chassis by one or two platforms, supported on a single foldable supporting structure

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3.3.5
double scissor lift
vehicle lift where the vehicle is supported on its frame by two separate platforms, which are moving vertically, each supported on two foldable supporting structures

3.3.6
single column lift
vehicle lift with a vertical supporting structure where a single lifting element is supporting a whole vehicle on its frame or on its wheels

3.3.7
two column lift
vehicle lift with a fixed vertical supporting structure where two lifting elements are supporting the vehicle on its frame or on its wheels

3.3.8
four column lift
vehicle lift where the vehicle is supported on its wheels by platforms rising and lowering along four vertical fixed columns

3.3.9
in-ground piston lift
vehicle lift where the vehicle is supported on its frame, axles or wheels by a single/multiple hydraulic lifting unit(s), partially or totally fitted below ground level

3.3.10
in-ground scissor lift
vehicle lift where the vehicle is supported on its frame, axles or wheels by a foldable structure, partially or totally fitted below ground level

3.3.11
mobile column lift
combination of independent lifting units, each with a vertical supporting structure supporting part of a vehicle on its frame or on a wheel, acting as one lift

Note 1 to entry: A mobile column lift is a special case of multiple lifting unit lift.

Note 2 to entry: A single independent lifting unit part of a mobile columns lift is not designed to raise a vehicle but shall be combined with other units to achieve that.

3.3.12
platform lift
vehicle lift where the vehicle is supported on its wheels or chassis by one or two separate platforms

3.3.13
rolling jack
auxiliary lifting device used typically to raise just one end of the vehicle

Note 1 to entry: A rolling jack cannot be used as a stand-alone device but shall always be used in conjunction with another lift, typically a platform lift or a 4 post lift.

Note 2 to entry: Synonyms for rolling jack are e.g. pit jack, jacking beam.

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3.3.14
mobile vehicle lift
movable vehicle lift equipped with wheels, rollers, etc. such that it can be moved from one place to another without load and can fulfil its function without being fixed to the floor

3.3.15
manually driven vehicle lift
vehicle lift where the load carrying device is driven by manual effort

3.3.16
power-driven vehicle lift
vehicle lift where the load carrying device is driven by effort other than manual

3.3.17
mechanically driven vehicle lift
power-driven lift not using hydraulic nor pneumatic fluid power

3.4 Safety related parts

3.4.1
catching device
mechanical safety device which holds the load carrying device in case of failure of a lifting element

Note 1 to entry: See Figure 3.

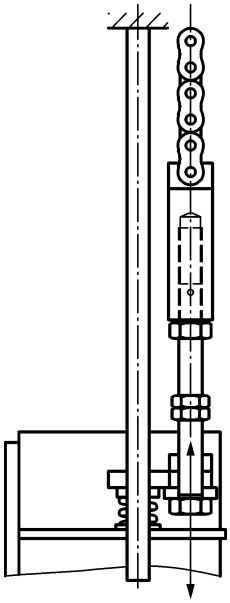


Figure 3 — Catching device

3.4.2
latch
device normally used to prevent unexpected movements in lifts operated by hydraulic/pneumatic cylinders

Note 1 to entry: A latch can e.g. consist of a ratchet and pawl device.

Note 2 to entry: See Figures 4 and 5.

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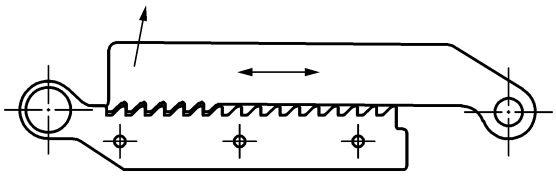


Figure 4 — latch consisting of hooks

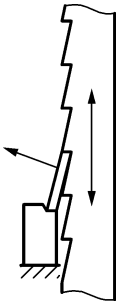


Figure 5 — latch consisting of pawl

3.4.3
pipe rupture valve
valve that limits the unintentional lowering speed of the lift in case of breakage of a hydraulic pipe

3.4.4
total hydraulic redundancy
characteristic of the hydraulic system of a lift with two or more hydraulic lifting elements for which any hydraulic leaks do not compromise the safety of the lift

3.4.5
holding device
device, which holds the load carrying device automatically in a stationary raised position

3.4.6
re-raising prevention device
device which prevents re-raising of load carrying device from the initial position in the event of failure of the lifting element

3.4.7
automatic brake
braking device which is normally held on and which is released only by application of power

Note 1 to entry: Operation of the braking device is also instigated automatically by releasing the lift controls and by interruption of the power supply.

3.4.8
self braking system
system which, due to its inherent resistance to movement, stops the movement of the load carrying device when the drive power is interrupted

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3.4.9
safety switch
switch which performs a safety function as defined in 3.30 of EN ISO 12100:2010

Note 1 to entry: The whole of the specified opening of the contacts should be achieved by operation of the control mechanism through its intended travel using the force stated by the manufacturer of the switch (see K.2.1 of EN 60947-5-1:2017).

4 Safety requirements and/or measures

4.1 General

Machinery shall comply with the safety requirements and/or protective measures of this clause.

In addition, the machine shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

4.2 Preventing unauthorised operation

Vehicle lifts shall be equipped with an accessible and fixed device that prevents unauthorized use after taking the lift out of operation (refer to Annex C).

4.3 Control devices

4.3.1 Hold-to-run control

Control devices shall be of the hold-to-run type. The functions of the command shall fulfil the conditions of performance level b of EN ISO 13849-1:2015. The stop-function shall comply with category 0 of 9.2.2 of EN 60204-1:2018.

4.3.2 Grouped control devices

If the control devices for more than one vehicle lift are grouped together in one position, each control device shall be clearly marked to show which vehicle lift it controls.

4.3.3 Logical operation

The control devices shall be designed so that the movement of the control and its location are consistent with its effect (refer to Annex C).

4.3.4 Marking

The direction of the movement of the load carrying device shall be permanently marked (refer to Annex C). The marking shall be suitable symbols or text and can be located on the control devices themselves or directly adjacent to them.

4.3.5 Unintentional operation

Control devices shall be protected from unintentional operation (refer to Annex C).

4.4 Controls

4.4.1 General

Control devices shall be designed and arranged so that the operator is not jeopardized by the lift or by the load and can keep watching the hazardous area, to avoid risk of harm to bystanders.

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Where it is possible to control the lift by using more than one control device, there shall be measures to ensure that only one control has priority at any time. The priority shall be chosen by a selector switch, which enables only one control device at a time or, in the absence of such a selector switch, by automatic exclusion of the control device not operating when the prioritized one is activated.

Safety related parts in the selection system shall comply with performance level c category 2 of EN ISO 13849-1:2015.

4.4.2 Fixed controls

Fixed controls shall be designed and arranged so that they are within easy reach of a standing operator and should not be higher than 1,8 m from the floor level.

If the conditions are such that the hazardous area cannot be completely viewed by the operator at the fixed control, suitable control measures shall be provided so that:

— they allow the hazardous area to be viewed by the operator; or

— any bystander is effectively alerted to the risk associated with their presence in the hazardous area while the lift is moving.

This shall be done through the use of suitable devices (like audible/visual warning signal, refer to Annex C) and not just through warning instructions.

These devices shall operate in any condition where the risk is present.

This applies to the operation of both vehicle lifts and multiple lifting unit lifts.

For lifts installed in particularly limited areas (e.g. paint booth) the presence of a bystander is potentially negligible (and in any case the operator is still able to make sure that there are no risk situations) so additional warning devices may not be required.

For pinching and shearing risk see 4.17.

For further risk see Annex C.

4.4.3 Mobile controls

In relation to the risks associated with use, mobile controls can be divided into two categories:

a) devices that do not enable the operator to move inside the hazardous area; and

b) devices that enable the operator to move inside the hazardous area.

Devices of type a), like pendant mobile controls with short connecting cable, do not imply any special requirement other than those considered for fixed controls.

Devices of type b), usually called “remote controls”, can be divided in two categories, wireless or wired, but both are allowed only if the additional hazards are controlled (refer to Annex C).

The use of mobile controls shall be subject to the deactivation of main control, except emergency stop controls and eventual consensus control devices.

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Special requirements for wireless remote controls:

— Wireless remote control, if active for the complete stroke, shall conform to Annex F. Alternatively, it can comply with Annex C of EN 13557:2003+A2:2008. In this case the stop function mentioned in EN 13557:2003+A2:2008, C.3, shall be designed to achieve performance level d or higher according to EN ISO 13849-1:2015.

— Only one wireless remote control can be connected to one lift at any one time. This can be either a fixed combination of remote controls and lifts or a programmable remote control that can be used with more lifts but is always limited to one lift at a time.

— In all cases it should be clear which lift the remote control is connected to before movement of the lift is started.

— Wireless remote controls shall be individually paired to the lift they operate.

— The pairing process shall be conducted by the operator and shall expire in such a way as to ensure that unintentional operation of a lift is impossible (refer to Annex C).

— The disconnection of a remote control should not affect any activation of an emergency stop. (the emergency state condition should remain until the emergency stop has been reset. Reset of emergency stop signal shall only be possible from the fixed/main control position).

— To identify any recognition modes for the connection between the wireless remote control and the lift, see Annex C.

4.4.4 Controlling multiple Lifting Unit Lift

If a single independent lifting unit of a multiple lifting unit lift is intended to be moved independently, a selection control shall be provided that enables:

a) the independent movement of each independent lifting unit; and

b) movements of all the independent lifting units together.

Other combinations of movements of the independent lifting units may also be incorporated and selected by the selection control.

The non-selected independent lifting units shall be prevented from operating.

4.4.5 Emergency stop device

The main switch can act as an emergency stop (refer to 5.3.3 and 10.7.3 of EN 60204-1:2018).

In a multiple lifting unit lift for rail-bound vehicles, each control position shall be equipped with an emergency stopping device which fulfils the requirements of EN ISO 13850:2015 and stops the movement of all lifting units within the limits given in 4.15c. The emergency stop function shall comply with performance level d of EN ISO 13849-1:2015.

On all other vehicle lifts, an emergency stopping device is not required because activation of it would not lessen the risk (due to the fact that it would not reduce the stopping time).

The stop-function shall comply with category 0 of 9.2.2 of EN 60204-1:2018.

If an emergency stop is fitted on other types of vehicle lifts, the safety related parts in the control system shall comply with performance level c of EN ISO 13849-1:2015.

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4.4.6 Stopping device

Each control station shall be equipped with a separate device to stop all movements which have been initiated by a control. This device shall have priority over the start controls and be able to stop the movements also in case of one failure as mentioned in EN ISO 13849-2:2012.

If an emergency stopping device is fitted, a separate stopping device is not necessary.

4.5 Duplicated drive systems

Drive systems which are both power driven and manually driven shall be designed in such a way that neither drive can put the other drive into motion.

4.6 Speeds

The speed for lifting and lowering shall not exceed 0,015 m/s for vehicle lifts of rail bound vehicles (trains, trams, etc.) and 0,15 m/s for other vehicle lifts.

4.7 Structural design of the supporting structure

4.7.1 General

The design of vehicle lifts in relation to materials, construction and equipment shall be such that a satisfactory level of safety is achieved under all operating conditions including the failure situations described in this document. This shall be demonstrated by calculation. Use of the permissible stress method is allowable.

The stress, resulting from the most unfavourable load distribution, shall be calculated for each part which is structurally loaded according to all the applicable load combinations listed in Table 2. For permissible stresses refer to Annex B. The values of Annex B are given under the condition of 22 000 load cycles at rated load. If this value is exceeded, fatigue calculation shall be performed for structure and mechanism.

Wheel support vehicle lifts for road vehicles shall be designed in such a way that during normal operation the maximum inclination of the platforms in its longitudinal axes is limited to 1°.

On chassis supporting vehicle lifts loaded with rated load the inclination of the level of the pick up device shall not exceed 3° from the horizontal. For test methods refer to Annex G.

4.7.2 Loads and forces

4.7.2.1 Regular loads

a) Structural loads

The gravitational masses of components of the vehicle lift are used to calculate the structural loads.

1) Loads due to components which are not moving are considered to be static structural loads.

2) Loads due to moving components are considered to be dynamic structural loads.

b) Rated load/Lifting capacity

Excluding multiple lifting unit lifts, the rated load corresponds to the maximum weight of the vehicle that can be lifted and one shall refer to the normative vehicle or to the special vehicle in case of lifts mentioned in 4.7.4.4.

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For multiple lifting unit lifts, where the vehicle is lifted by columns acting on the single wheel or axles but not necessarily on all of them simultaneously (e.g. mobile column lifts, acting on single-wheel or inground piston lifts, acting on single axle, ...), due to the variability of the configuration, it is not possible to refer to the normative vehicle so the "rated load" is replaced by the "lifting capacity", referred not to the whole vehicle but to the single lifting unit.

c) Dynamic forces

Dynamic forces are due to working movements such as raising, lowering and tipping in service. These shall be taken into account by multiplying the moved structural loads and the payload by the dynamic factor ϕ, which shall be calculated in relation to the nominal speed v in metres per second. An alternative to this is to take ϕ equals to 1,151 since the factor 0,34v is of the order 0,051 maximum.

$$\Phi = 1,1 + 0,34v$$

d) Manual forces

Manual force is produced by operators. This force shall be taken as 1 000 N acting horizontally at the height of the load carrying device.

For motor bike lifts this force shall be-not less than 500 N.

e) Effects of accessories

The designer shall take into account the effect that any approved accessories may have on the loading of the lift. (For example-rolling jack). Manual forces and dynamic forces do not act simultaneously and shall not be combined. Manual forces and static forces shall be combined.

4.7.2.2 Occasional loads – In-service wind

If the vehicle lift is designed for outside use, the influence of wind forces in the wheelbase direction shall be included in the stress calculation (see also 4.7.3) and overturning calculation (see also 4.7.6).

The maximum pressure of in-service wind is 125 N/m^2, which is related to a wind speed of 14 m/s (50,4 km/h).

The wind forces acting on the normative vehicle (refer to Table 3) shall be derived from Table 1.

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Table 1 — Wind forces and stabilizing effects

Rated load/ Lifting capacity t	Wind force F_W kN		Stabilizing weight effect [kN] and exposed surface [m^2]	Axle wind force ratio		
	In service	Out of service		F_1/F_W	F_2/F_W	F_3/F_W
a) P ≤ 0,6	0,125	0,5	1	0,40	0,60	/
b) P ≤ 1	0,375	1,5	3	0,40	0,60	/
c) P ≤ 1	0,375	1,5	3	0,40	0,60	/
d) P ≤ 2,5	0,75	3	6	0,40	0,60	/
e) 2,5 < P ≤ 3,5	1	4	8	0,40	0,60	/
f) 3,5 < P ≤ 7,5	1,875	7,5	15	0,33	0,66	/
g) 7,5 < P ≤ 20	2,25	9	18	0,33	0,66	/
h) 20 < P ≤ 30	2,625	10,5	21	0,33	0,66	/
i) 30 < P ≤ 40	3	12	24	0,45	0,55	/
j) P ≤ 25	5,25	21	42	0,25	0,30	0,45
k) P ≤ 40	4,875	19,5	39	0,20	0,30	0,50
l) 40 < P ≤ 52	5,25	21	42	0,20	0,30	0,50
m) P ≤ 40	4,125	16,5	33	0,17	0,33	/
n) 40 < P ≤ 52	4,875	19,5	39	0,17	0,33	/
o) P ≤ 45	4,875	19,5	39	0,20	0,40	0,40

4.7.2.3 Exceptional loads

a) Out-of-service wind

If the vehicle lift is designed for outside use, the influence of wind forces in the wheelbase direction shall be included in the stress calculation (see also 4.7.3).

The maximum pressure of out-of-service wind is 500 N/m^2, which is related to a wind speed of 28 m/s.

The wind forces acting on the normative vehicle (refer to Table 3) shall be derived from Table 1.

This document assumes that an operator will lower a raised vehicle to the ground level or as low as possible when he/she is not working on it. A corresponding requirement shall be written in the operation instructions if the vehicle lift is designed for outside use.

For the overturning stability calculation, a stabilizing weight effect of 1 kN for each square metre of exposed vehicle surface to the wind can be considered as stabilizing moment (refer to Table 1).

b) Action

1) of the catching device; or

2) of the re-raising prevention device.

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c) Test load for:

1) dynamic test (see 5.6.2);

2) static test (see 5.6.3).

4.7.3 Load combinations

The loads defined in 4.7.2 shall be combined and classified as indicated in Table 2.

Table 2 — Load combinations

Load	Clause	Load combination						
		A1	A2	B1	B2	C1	C2	C3
Regular loads	4.7.2.1							
Structural loads – static	a1	1	1	1	1	1	1	1
Structural loads – dynamic	a2	ϕ	1	ϕ	1	1	ϕ	1
Rated load/lifting capacity	b	ϕ	1	ϕ	1	1	ϕ	1
Manual forces	d	-	1	-	1	-	-	-
Effect of accessories	e	ϕ	1	ϕ	1	1	1	1
Occasional loads - In-service wind	4.7.2.2	-	-	1	1	-	-	-
Exceptional loads	4.7.2.3							
Out-of-service wind	a	-	-	-	-	1	-	-
Action of the catching device	b1	-	-	-	-	-	1	-
Action of the re-raising prevention device	b2	-	-	-	-	-	-	1

Key

Load combination A1: Normal operation (raising/lowering) without wind or special forces

Load combination A2: Normal operation (service/repair work) without wind or special forces

Load combination B1: Normal operation (raising/lowering) with wind force

Load combination B2: Normal operation (service/repair work) with wind force

Load combination C1: Vehicle lift out of service with wind force

Load combination C2: Action of the catching device

Load combination C3: Action of the re-raising prevention device

ϕ: Multiplication factor according to 4.7.2.1.

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4.7.4 Load distribution

4.7.4.1 General

Vehicle lifts shall be designed, manufactured and used only referring to the type of vehicle support specified by the manufacturer. Proper instruction shall be given in the information for use.

By limiting the considerations to normal vehicle lifts only (for lifts for rail bound vehicles as well as those for special vehicles, see 4.7.4.4) the load distribution, related to the rated load, that is to be considered in the structural calculations of the lift, depends on the type of lift.

For this purpose, 3 lift categories are identified:

a) Wheel support vehicle lifts (e.g.: lift with platforms) excluding those in category c;

b) Chassis supporting vehicle lifts (e.g.: two column lifts);

c) Multiple lifting unit lifts, acting on single wheel or single axle (e.g.: mobile column lifts, inground truck piston lifts).

For lifts of categories a) and b), the load distribution refers to normative vehicle, according with 4.7.4.2 and 4.7.4.3.

For category c), as it is not possible to refer to the normative vehicle, reference shall be made to the lifting capacity of the single lifting unit.

Even if a lift (category a) und b)) is equipped with overload protection device, the rated load shall only be defined on the basis of the normative vehicle (and therefore in reference to 4.7.4.2 and 4.7.4.3). The manufacturer can, however, state the possibility of lifting higher loads in relation to different load distributions as long as they are compatible with the effects of the load limiting devices and considered in the dimensioning of the load bearing parts of the lift.

These higher liftable loads shall be presented in such a way as not to create confusion with the actual rated load of the lift, which shall only be defined in reference with the normative vehicle.

The safety related parts in the control system of overload protection devices shall comply with Pl c according to EN ISO 13849-1:2015.

4.7.4.2 Wheel support vehicle lift for road vehicles

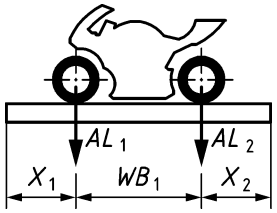
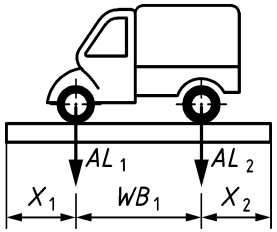
The rated load shall be distributed according to normative vehicle data as shown in Table 3. Consideration shall be given in each case to normative vehicles both less than and equal to the rated load to ensure that the most adverse loading situations are considered.

Vehicle positioning on platforms shall be considered in both directions, with the vehicle track symmetry axis and the platforms' symmetry axis coincidental and in any case in the most burdensome positions in relation to the elements being checked, also including those relating to the vehicle entry and exit phases from the lift.

When calculating for platforms, the plate stresses caused by supporting the loads shall be taken into account assuming that the load is uniformly distributed on a square or circular area at a pressure of 50 N/cm^2. In the case of a virtual axle the force to be considered for calculating plate stresses shall be equally distributed on each axle. Plate stresses need not be considered if the plain area between any two flanges or supporting sections is not considered when calculating the supporting cross section.

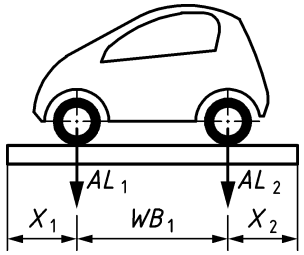
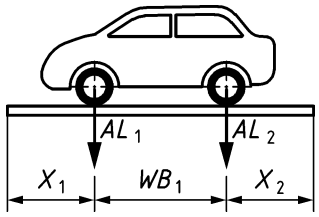
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Table 3 — Normative vehicle

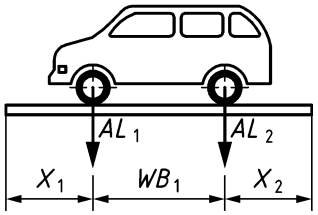
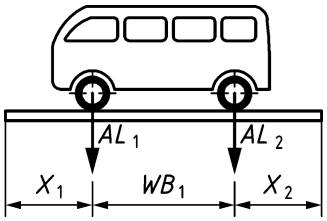
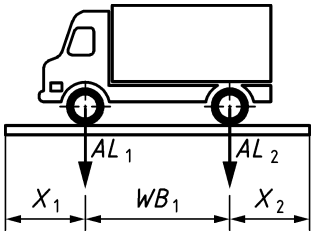
		NORMATIVE VEHICLES												
							Wheelbase			Axle load ratio			Min distance	
It	Rated Load (t)	Vehicle Type Vehicle Category	No. of axles	Normative vehicle	Wheel diam. (mm)	Wheel track WT (mm)	WB1 (mm)	WB2 (mm)	WB3 (mm)	AL1	AL2	AL3	X1 (mm)	X2 (mm)
a	P ≤ 0,6	-Two wheeled motorcycles Categories L1, L3	2		650	NA	1500	N/A	N/A	0,4	0,6	N/A	300	300
b	P ≤ 1	-Three wheeled motorcycles -Two wheeled motorcycles with side car -Powered tricycles Categories L2, L4, L5	2		450	1200	1600			0,4	0,6	N/A	200	200

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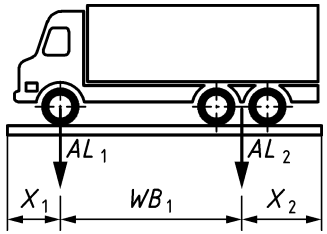
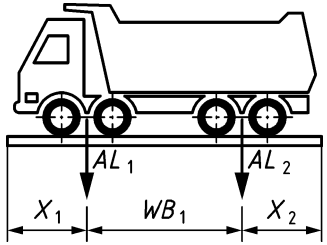
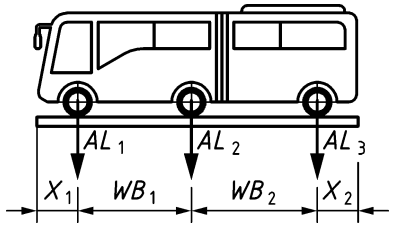
		NORMATIVE VEHICLES													
It	Rated Load (t)	Vehicle Type Vehicle Category	No. of axles	Normative vehicle	Wheel diam. (mm)	Wheel track WT (mm)	Wheelbase			Axle load ratio			Min distance	
							WB1 (mm)	WB2 (mm)	WB3 (mm)	AL1	AL2	AL3	X1 (mm)	X2 (mm)
c	P ≤ 1	-Light quadricycles (includes, light quadri mobiles, light on road quads, …) -Heavy quadricycles (includes heavy quadri mobiles, heavy on roads, heavy all terrain quads, side by side buggies, …) Categories L6, L7,	2		550	1200	1750	N/A	N/A	0,4	0,6	N/A	250	250
d	P ≤ 2,5	-Passenger cars Categories M1, M2	2		770	1500	2500	N/A	N/A	0,4	0,6	N/A	300	300

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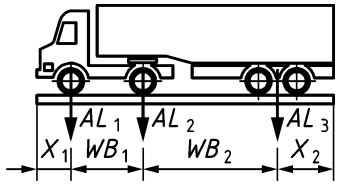
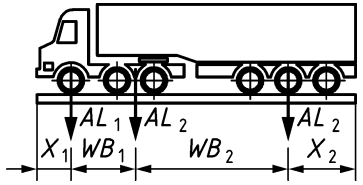
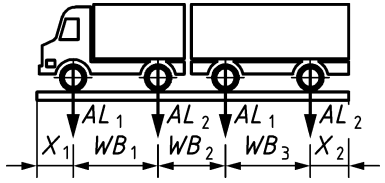
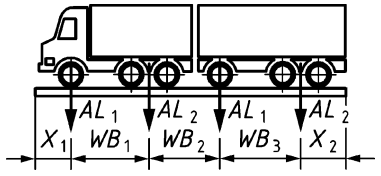
		NORMATIVE VEHICLES												
							Wheelbase			Axle load ratio			Min distance	
It	Rated Load (t)	Vehicle Type Vehicle Category	No. of axles	Normative vehicle	Wheel diam. (mm)	Wheel track WT (mm)	WB1 (mm)	WB2 (mm)	WB3 (mm)	AL1	AL2	AL3	X1 (mm)	X2 (mm)
e	2,5 < P ≤ 3,5	-Passenger cars, - (includes SUV, vans, campers, motorhomes, ...) -Light truck Categories M1, M2, N1	2		770	1600	3000	N/A	N/A	0,4	0,6	N/A	300	300
f	3,5 < P ≤ 7,5	-Bus -Trucks Categories M3, N_2	2		770	1700	3000	N/A	N/A	0,33	0,66	N/A	300	300
g	7,5 < P ≤ 20	-Lorries Categories, N_2, N3	2		900	1800	3500	N/A	N/A	0,33	0,66	N/A	500	500

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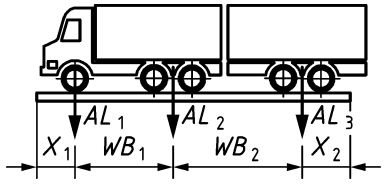
		NORMATIVE VEHICLES												
It	Rated Load (t)	Vehicle Type Vehicle Category	No. of axles	Normative vehicle	Wheel diam. (mm)	Wheel track WT (mm)	Wheelbase			Axle load ratio			Min distance	
							WB1 (mm)	WB2 (mm)	WB3 (mm)	AL1	AL2	AL3	X1 (mm)	X2 (mm)
h	20 < P ≤ 30	-Lorries Categories, N3	3		1050	1900	4000	N/A	N/A	0,33	0,66	N/A	500	1000
i	30 < P ≤ 40	-Dumper trucks/Tipping vehicles Categories, N3	4		1050	1900	4500	N/A	N/A	0,45	0,55	N/A	1000	1000
j	P ≤ 25	-Articulated busses Categories, M3	3		1050	1800	5500	6500	N/A	0,25	0,3	0,45	500	500

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		NORMATIVE VEHICLES													
							Wheelbase			Axle load ratio			Min distance	
It	Rated Load (t)	Vehicle Type Vehicle Category	No. of axles	Normative vehicle	Wheel diam. (mm)	Wheel track WT (mm)	WB1 (mm)	WB2 (mm)	WB3 (mm)	AL1	AL2	AL3	X1 (mm)	X2 (mm)
k	P ≤ 40	-Articulated lorries Categories, N3, O3, O4	4		1050	1900	3500	7000	N/A	0,2	0,3	0,5	500	1000
l	40 < P ≤ 52	-Articulated lorries Categories, N3, O3, O4	≥ 5		1050	1900	3500	7000	N/A	0,2	0,3	0,5	500	1600
m	P ≤ 40	-Lorries with trailer Categories, N3, O3, O4	4		1050	1900	3500	3000	3500	0,17	0,33	N/A	500	500
n	40 < P ≤ 52	-Lorries with trailers Categories, N3, O3, O4	≥ 5		1050	1900	4000	3000	4000	0,17	0,33	N/A	500	1000

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		NORMATIVE VEHICLES												
							Wheelbase			Axle load ratio			Min distance	
It	Rated Load (t)	Vehicle Type Vehicle Category	No. of axles	Normative vehicle	Wheel diam. (mm)	Wheel track WT (mm)	WB1 (mm)	WB2 (mm)	WB3 (mm)	AL1	AL2	AL3	X1 (mm)	X2 (mm)
o	P ≤ 45	-Lorries with trailers Categories, N3, O3, O4	≥ 5		1050	1900	4000	5000	N/A	0,2	0,4	0,4	500	10000

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4.7.4.3 Chassis supporting vehicle lift for road vehicles

The rated load shall be distributed according to normative vehicle schematised in a loading rectangle with the following characteristics:

A) Load distribution

The load ratios between the front and rear load carrying points shall be (in both directions):

— For rated loads ≤ 3,5 t: 0,4-0,6 (maximum load one pick-up point 0,3 rated load)

— For rated loads > 3,5 t: 0,25-0,75 (maximum load one pick-up point 0,375 rated load)

B) Load rectangle dimensions

The rated load shall be distributed on the four corners of a rectangle with the following dimensions (see Figure 6):

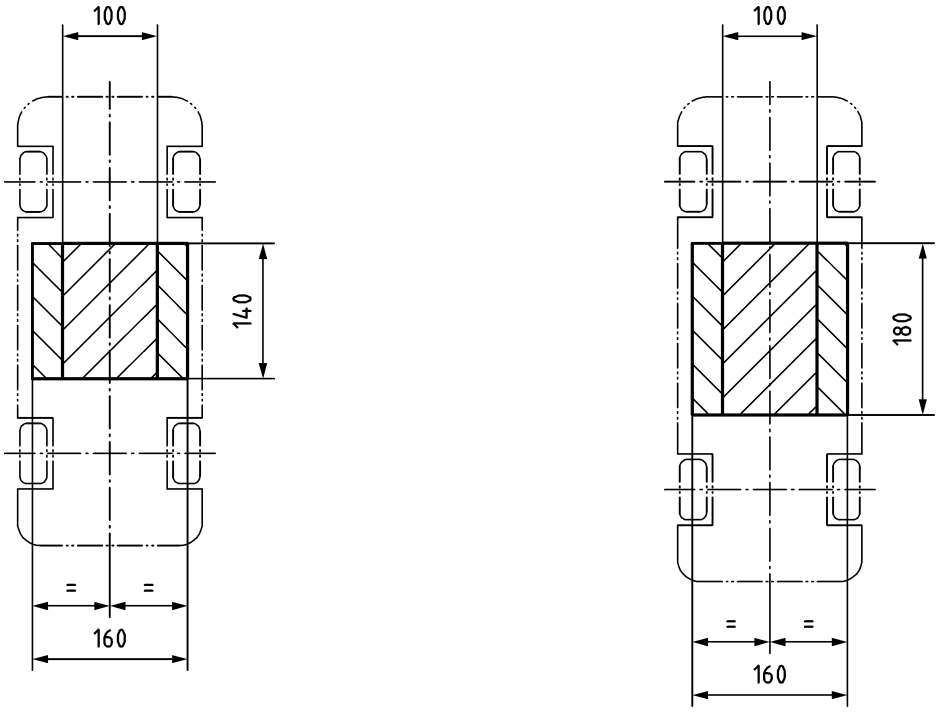
— For rated load ≤ 3,5 t: 100 cm (wheel track) x 140cm (wheelbase)

160 cm (wheel track) x 140cm (wheelbase)

— For rated loads > 3,5 t: 100 cm (wheel track) × 180 cm (wheelbase)

160 cm (wheel track) x 180 cm (wheelbase)

The load rectangle wheel track symmetry axis and the lift wheel track symmetry axis are coincidental.



rated load ≤ 3,5 t rated load > 3,5 t

Figure 6 — Load rectangle

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The load rectangle shall be positioned on the lift in the worst condition related to the part of the lift for which the calculation is done (this means that different positions could be considered according to the parts being tested).

In particular:

— In platform lifts:

  - if this is variable in length, the platform shall be considered at its maximum length.

— In lifts with carrying arms:

  - the load rectangle shall be positioned with the long arm to the maximum length rotated so as to intercept the distance of 100/160 cm in the wheel-track direction, and the short arm extended as far as necessary to intercept the distance of 100/160 cm and at the same time reach the distance 140cm (rated load ≤ 3,5 t) or 180 cm (rated load > 3,5 t) in the wheelbase direction. If it is not possible to meet the wheelbase distances then then it is acceptable to be as close as possible providing the final dimension is never less than either 140cm or 180cm, whichever case refers. (refer to Annex C).

Pick-up plates and their shafts shall be designed to suit the load acting at a point halfway between the centre and the outside edge of the pad.

4.7.4.4 Vehicle lifts for special vehicles

For a vehicle lift designed to lift special vehicles:

a) The design of the lift shall be in accordance with the actual load distribution of the special vehicle to be lifted. If the lift is intended for use with different special vehicles, the distribution shall suit the most unfavourable condition.

b) All lifts shall be equipped with clearly understood load distribution plates related with the special vehicle which is the intended use of the lift of sufficient size and placed in conspicuous locations.

c) If the lift is intended also for use with normal vehicles a second rated load shall be specified and the load distribution in this case shall be according with 4.7.4.2 and 4.7.4.3.

The rated load defined for special vehicles shall not be confused with the rated load referred to normal vehicles.

4.7.4.5 Combination with rolling jacks or other additional interchangeable equipment

If the vehicle lift is intended to be used in combination with pit jacks/rolling jacks or other additional interchangeable equipment these special forces and conditions shall be taken into consideration by design of the vehicle lift.

4.7.5 Lifting elements

4.7.5.1 Catching devices and mechanical re-raising prevention devices

If catching devices or re-raising prevention devices are activated, no permanent deformations shall occur in any part required for continued normal operation.

If permanent deformation occurs in such a device after activation, exact instructions shall be given in the operation manual with regard to the measures to be taken (e.g. replacement of the part, removal of burrs).

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4.7.5.2 Rope drives

Steel wire ropes for rope drives shall comprise a minimum of 114 single wires. The nominal tensile grade of each wire shall be at least 1 570 N/mm² but not exceed 1 960 N/mm².

The tensile grade of terminations shall be a minimum of 80 % of that of the rope.

For the terminations of wire ropes the following shall be used:

— splices;

— aluminium press ferrules;

— non-ageing steel press ferrules;

— wedge socket anchorages.

The minimum breaking force of the wire ropes shall be shown on a certificate.

Classification of rope drives mechanisms shall be calculated according to the total duration of the full load cycles the lift is designed for, according to the vertical displacement and the nominal vertical speed:

$$T_f = t_{av} \cdot C_f$$

where

C_f is the design number of full load cycles;

$t_{av} = \frac{\Delta H}{v_{avr}} + \frac{\Delta H}{v_{avl}}$ is the average duration of a cycle;

ΔH is the vertical stroke;

v_{avr} is the average raising speed in m/min;

v_{avl} is the average lowering speed in m/min.

The M-class of the rope drives mechanism is then established by matching the calculated total duration of the full load cycles the lift to the closest (higher) nominal value of T_f in Table 4.

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